

# Advancing Aquaporin Research

## Through Water Diffusivity Comparison

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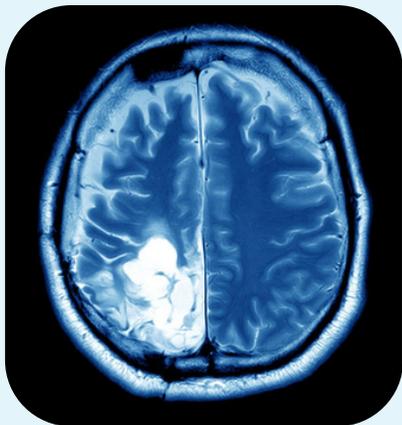
**Department** Chemical Engineering & Bioengineering



# Magnetic Resonance Imaging (MRI)

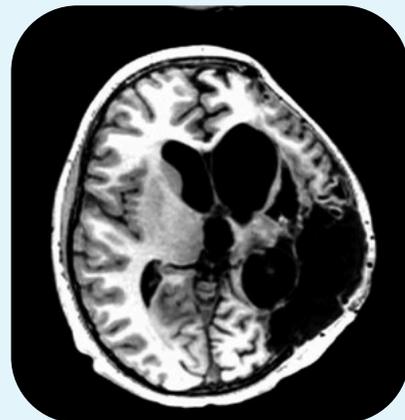
Nearly **40 Million** performed annually in US!

## Tumor



Via Harvard Health

## Traumatic Brain Injury



Via Frontiers

## Spinal Damage



Via Radiology Key

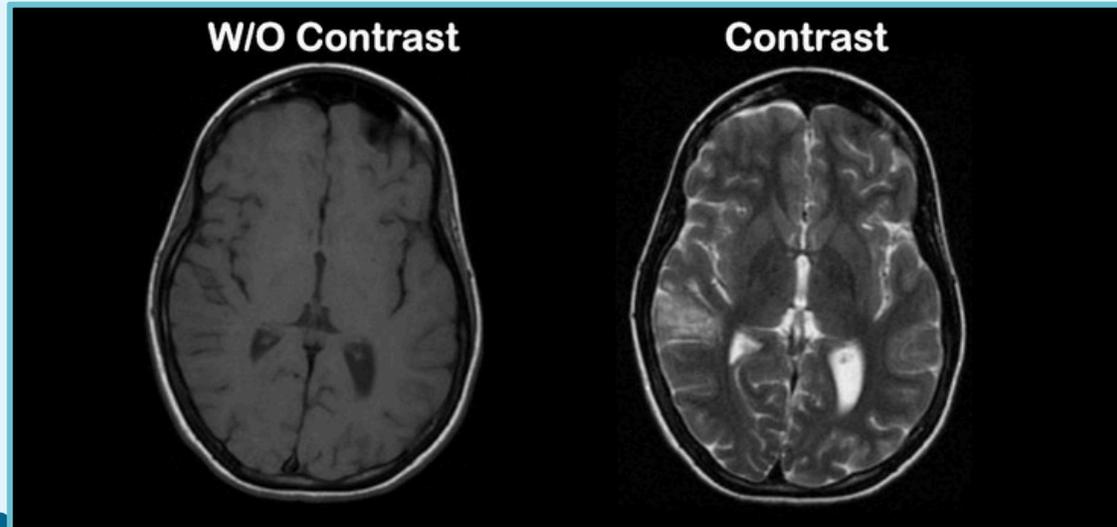
## Soft Tissue Damage



Via ScienceDirect

# Contrast MRI

## Pro

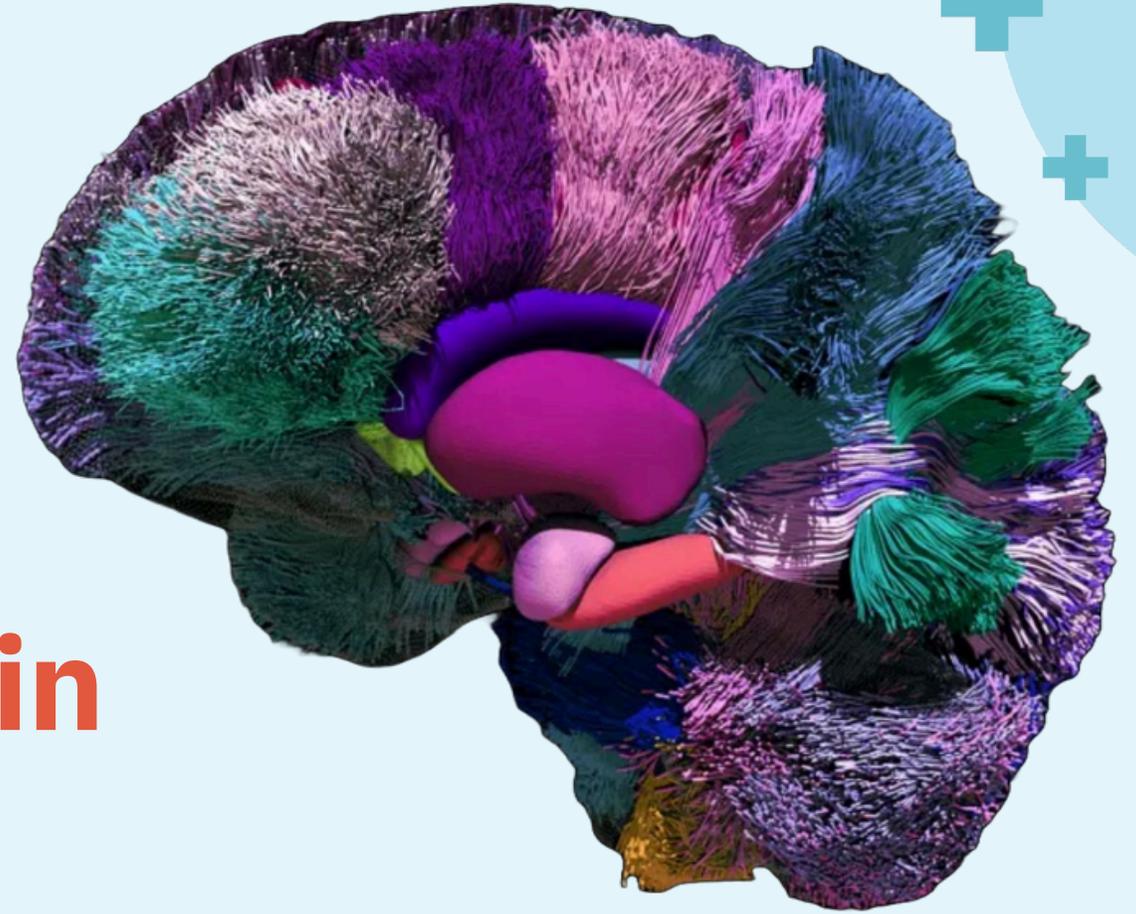


## Con

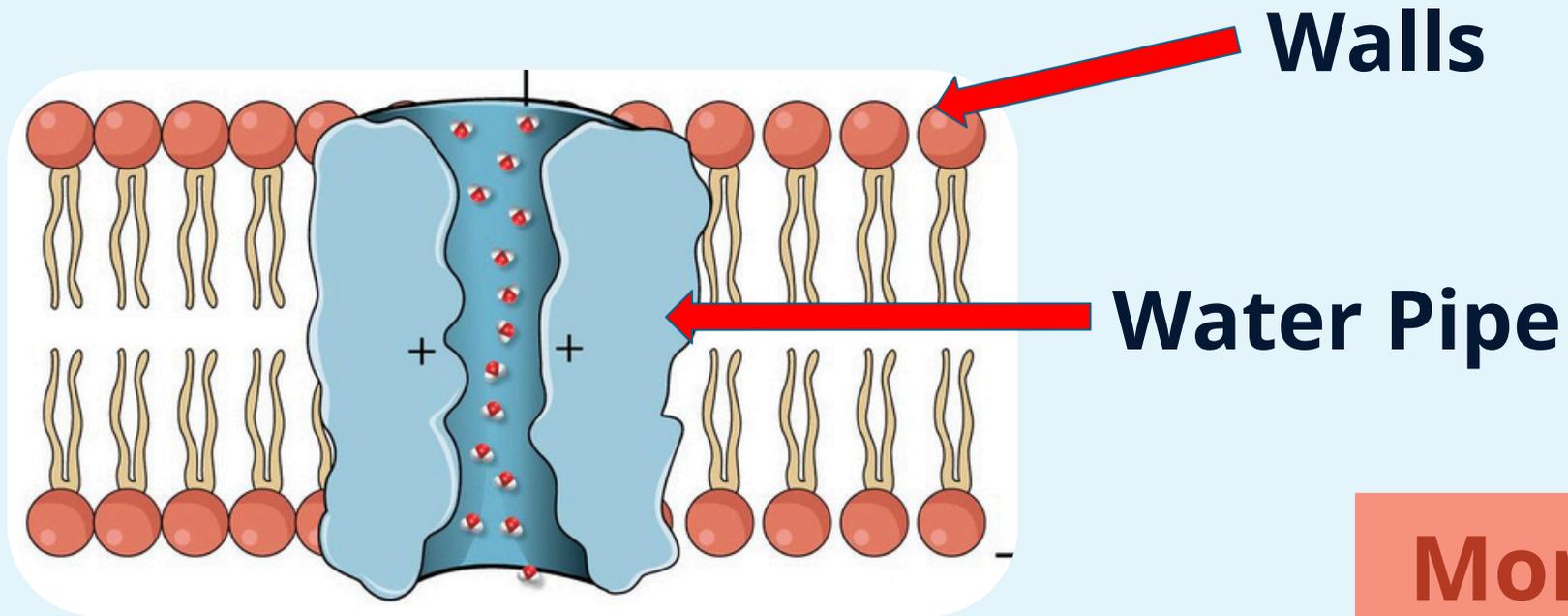
**Gadolinium** as a  
contrast agent

# Diffusion MRI

Mapping the brain  
using water!



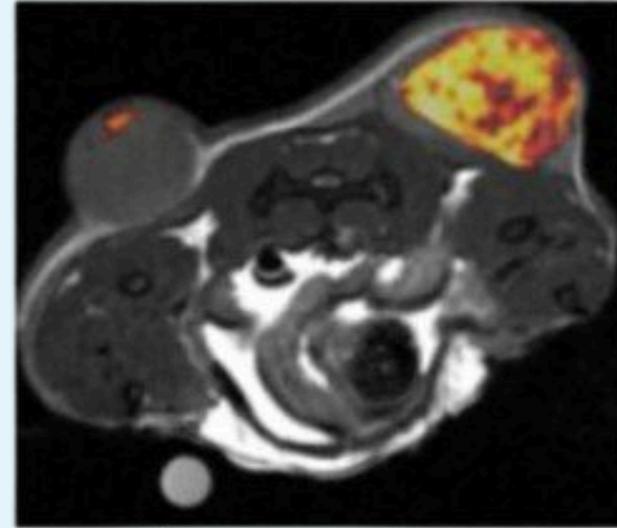
# The Aquaporin Protein



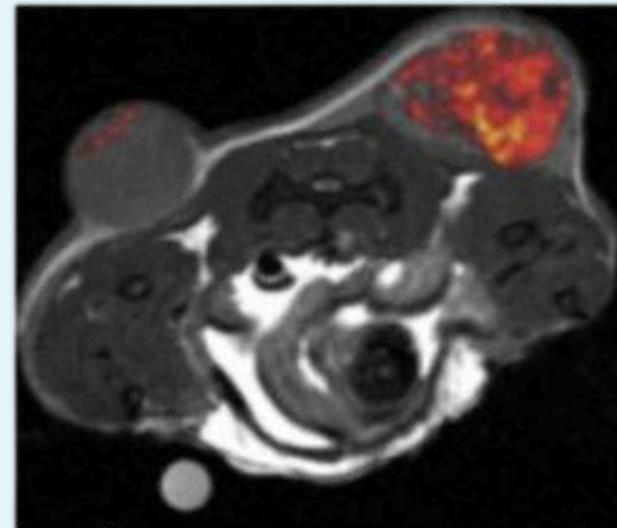
**Tiny channels that allow movement of water in & out of cells.**

**More pipes = more water goes into cell**

# The Aquaporin in Practice



**Aquaporin  
turned on**



**Aquaporin  
turned off**



# Our Mentor's Lab Goal

Identify a species' aquaporin that successfully creates high contrast diffusion MRIs



# Our Goal:

Comparing aquaporins from different species to human aquaporins

## Strawberry Aquaporin 1



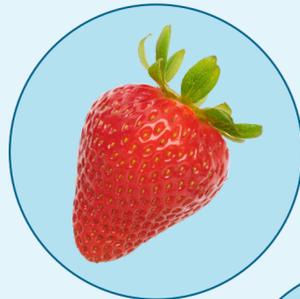
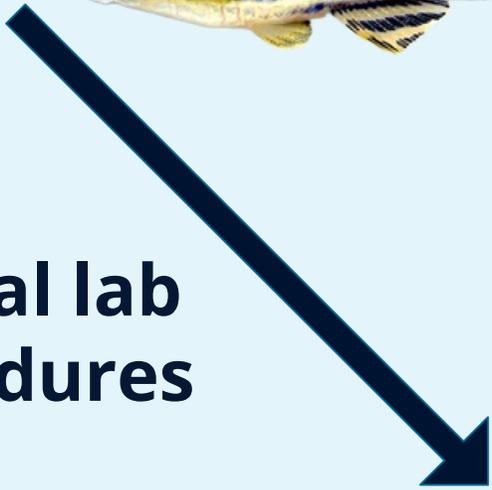
## Zebrafish aquaporin



# Analyzing MRI Contrast Levels



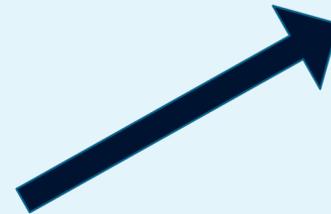
Several lab procedures



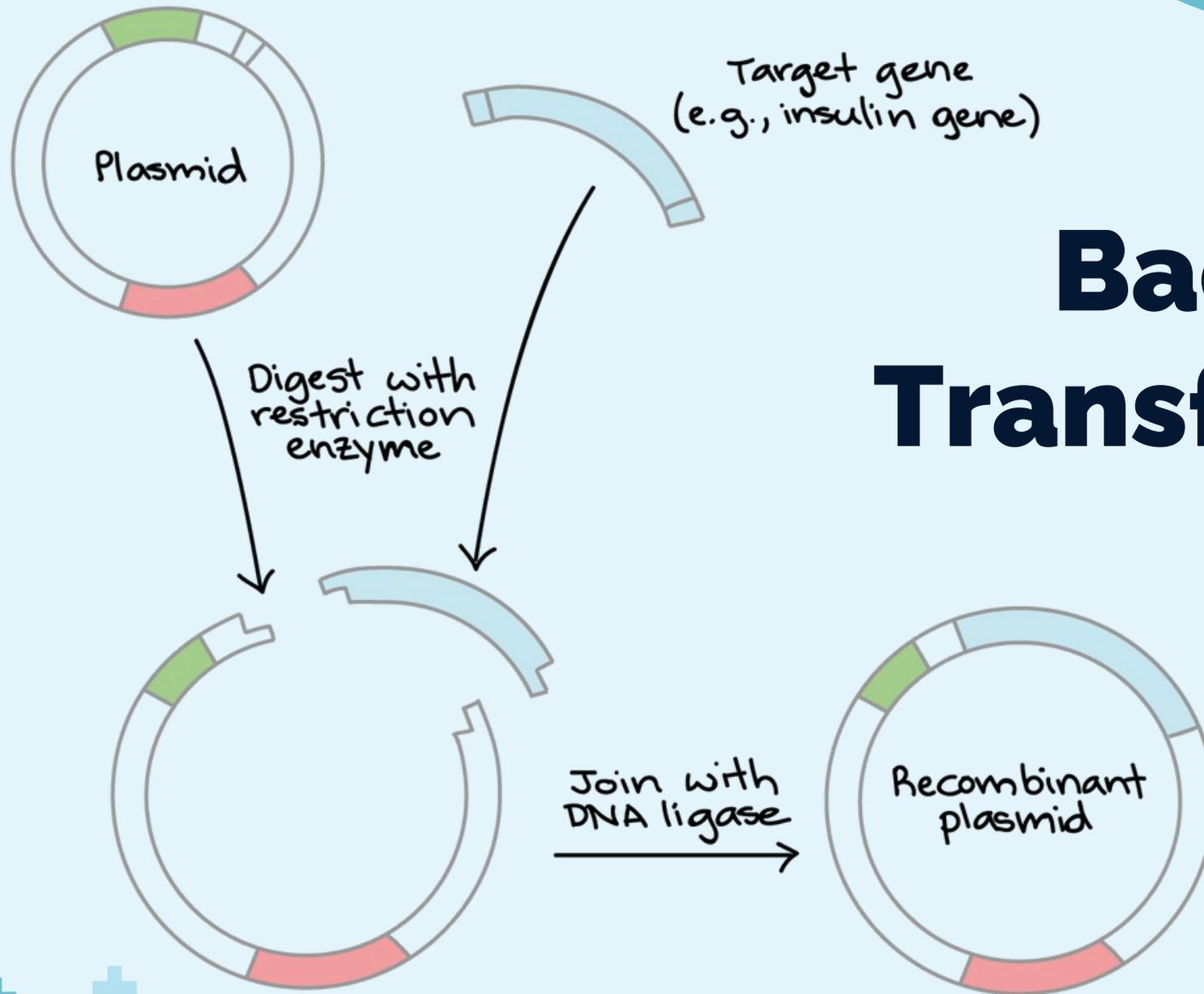
Hamster cells (CHO)



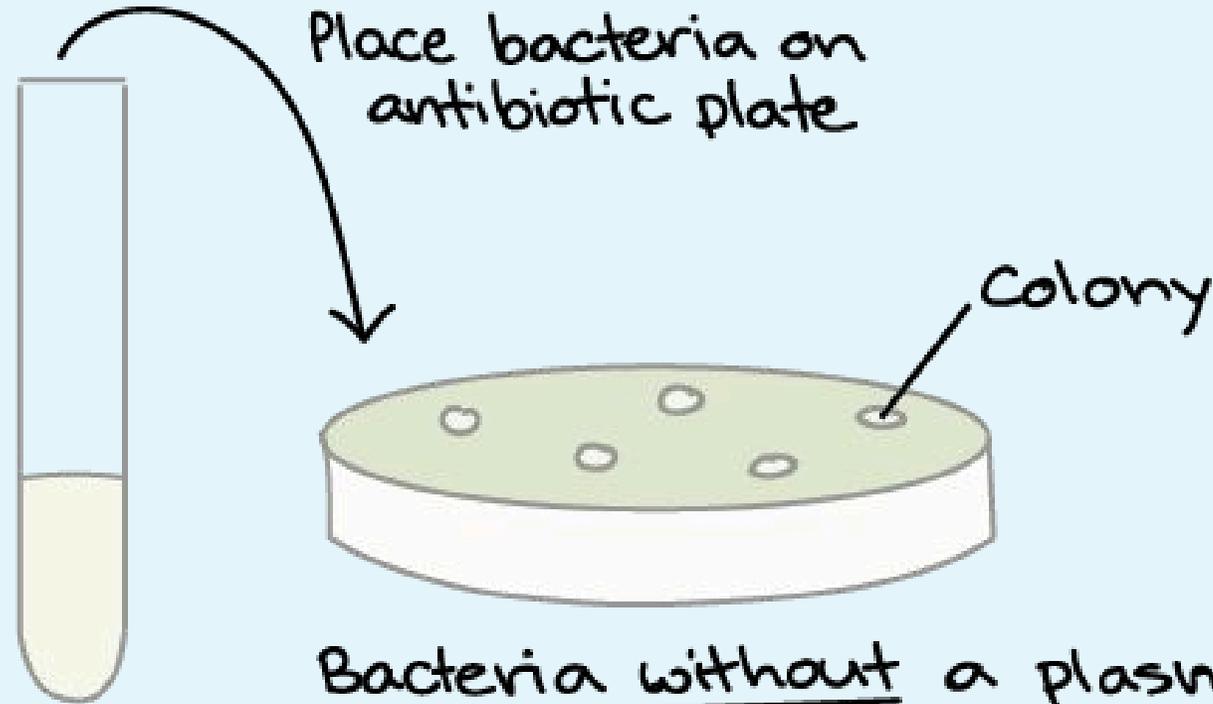
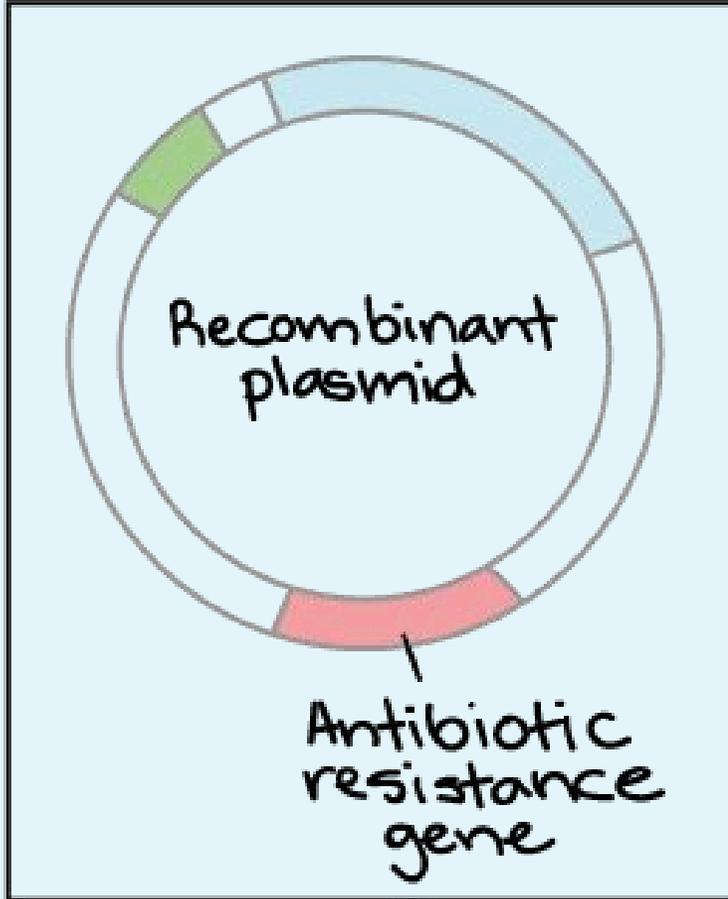
MRI machine



# Bacterial Transformation



# Bacterial Selection

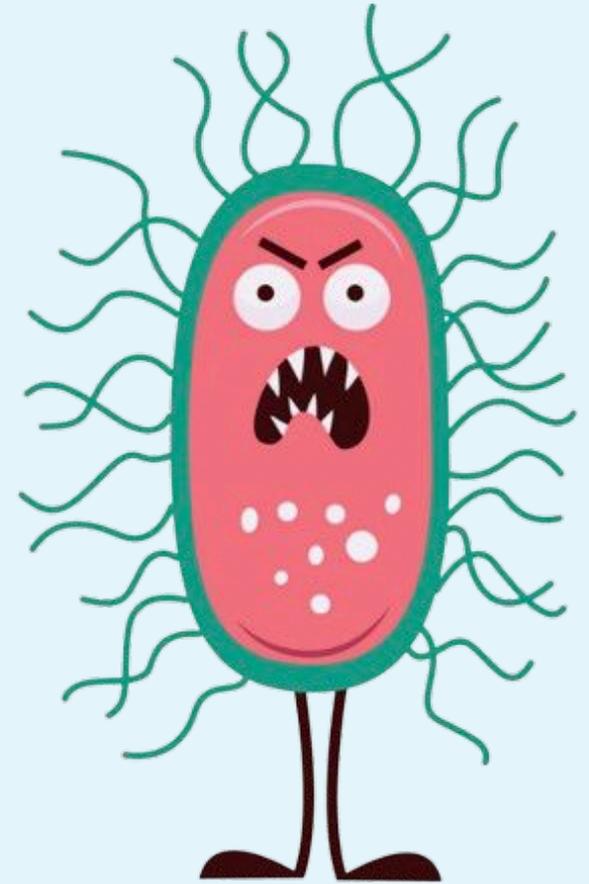


Bacteria without a plasmid die.  
Each bacterium with a plasmid makes a colony.

**The bacteria that grew is sent for sequencing!**

# We Faced Challenges

Our bacteria doesn't like us...



# Our New Genes of Interest:

## Strawberry Aquaporin 2



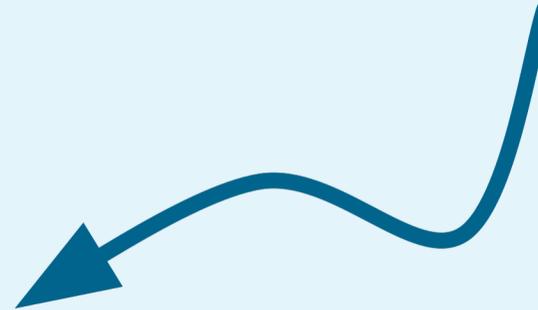
## Beetroot



**Bacterial  
Plasmid**



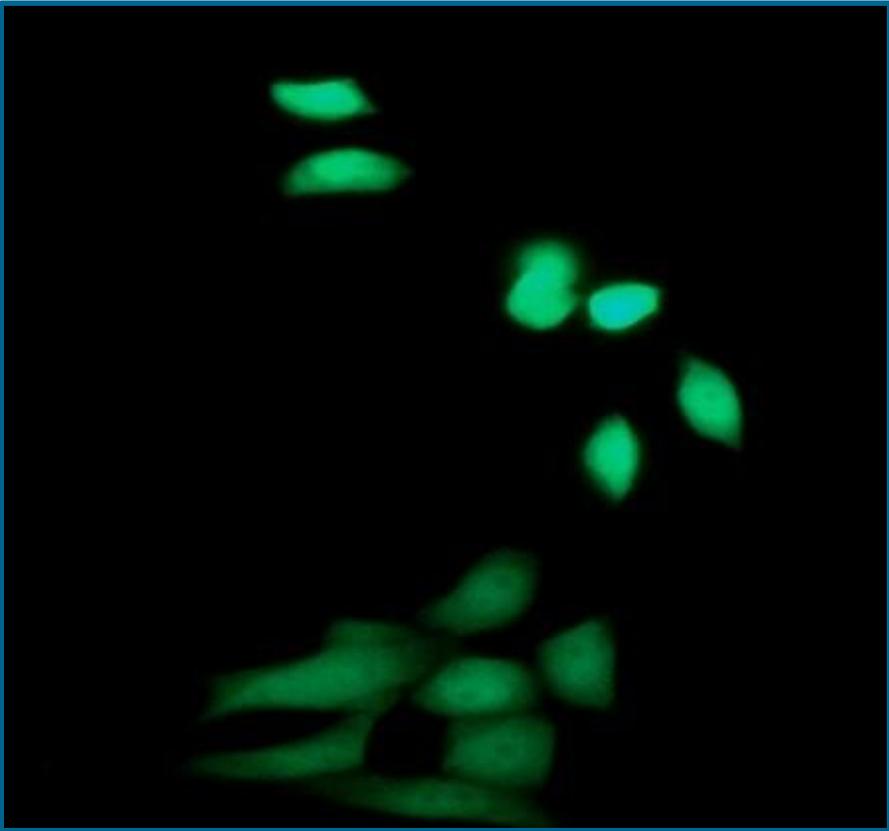
**Virus**



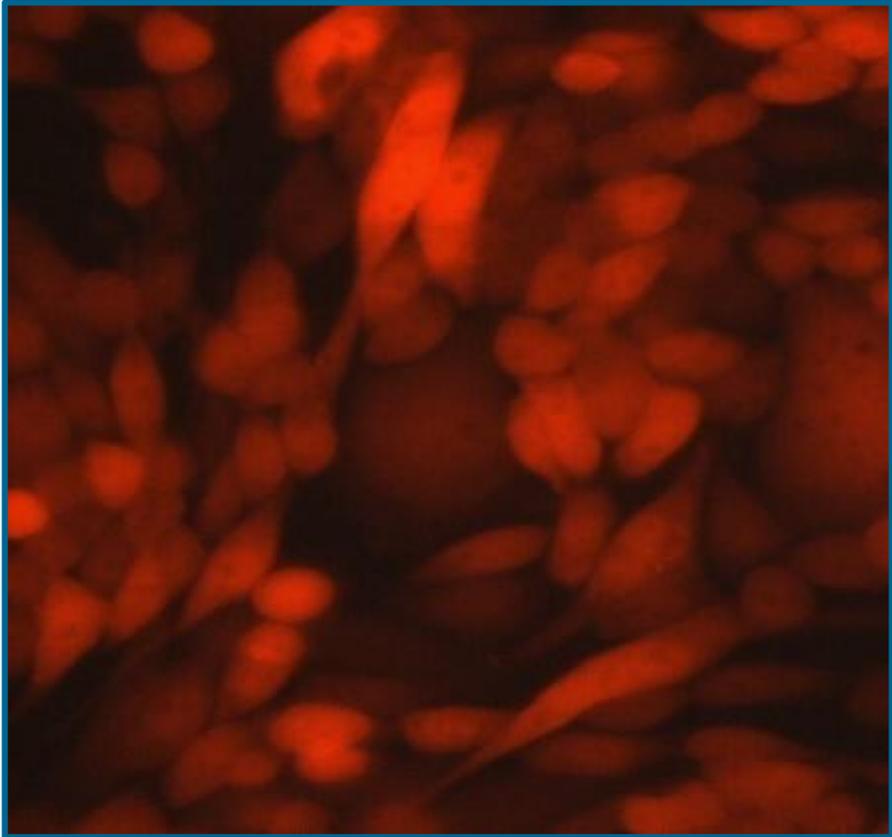
**Mammalian  
Cell**



# Our Infected Mammalian Cells



**Strawberry Aquaporin**



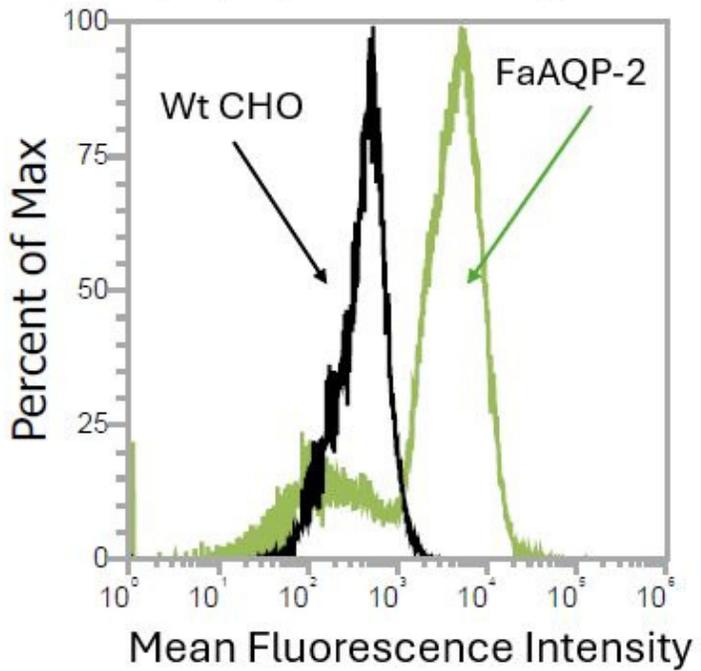
**Beetroot Aquaporin**

# Identifying a Pure Population



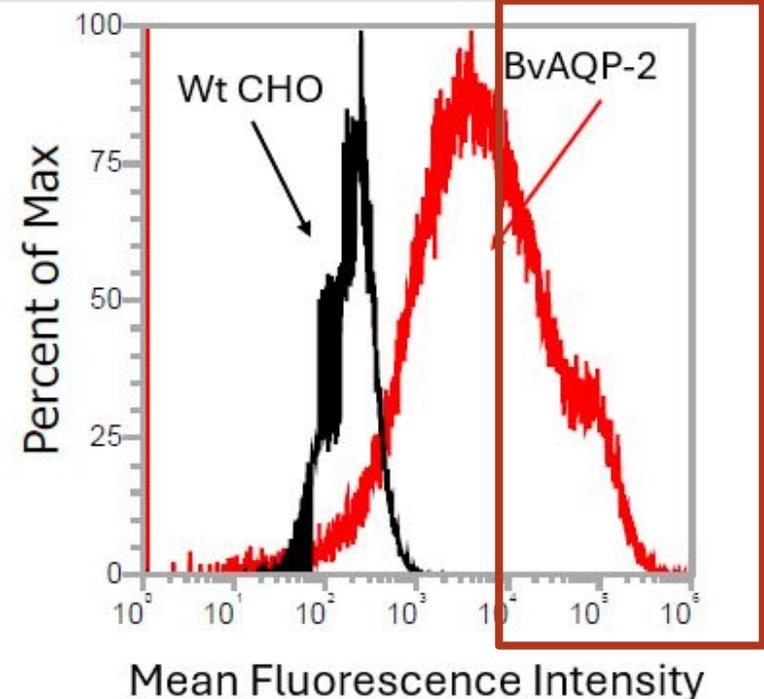
Data

Wild Type cells vs. Strawberry Cells



Data

Wild Type cells vs. Beetroot Cells



# Process of Getting our MRI Image

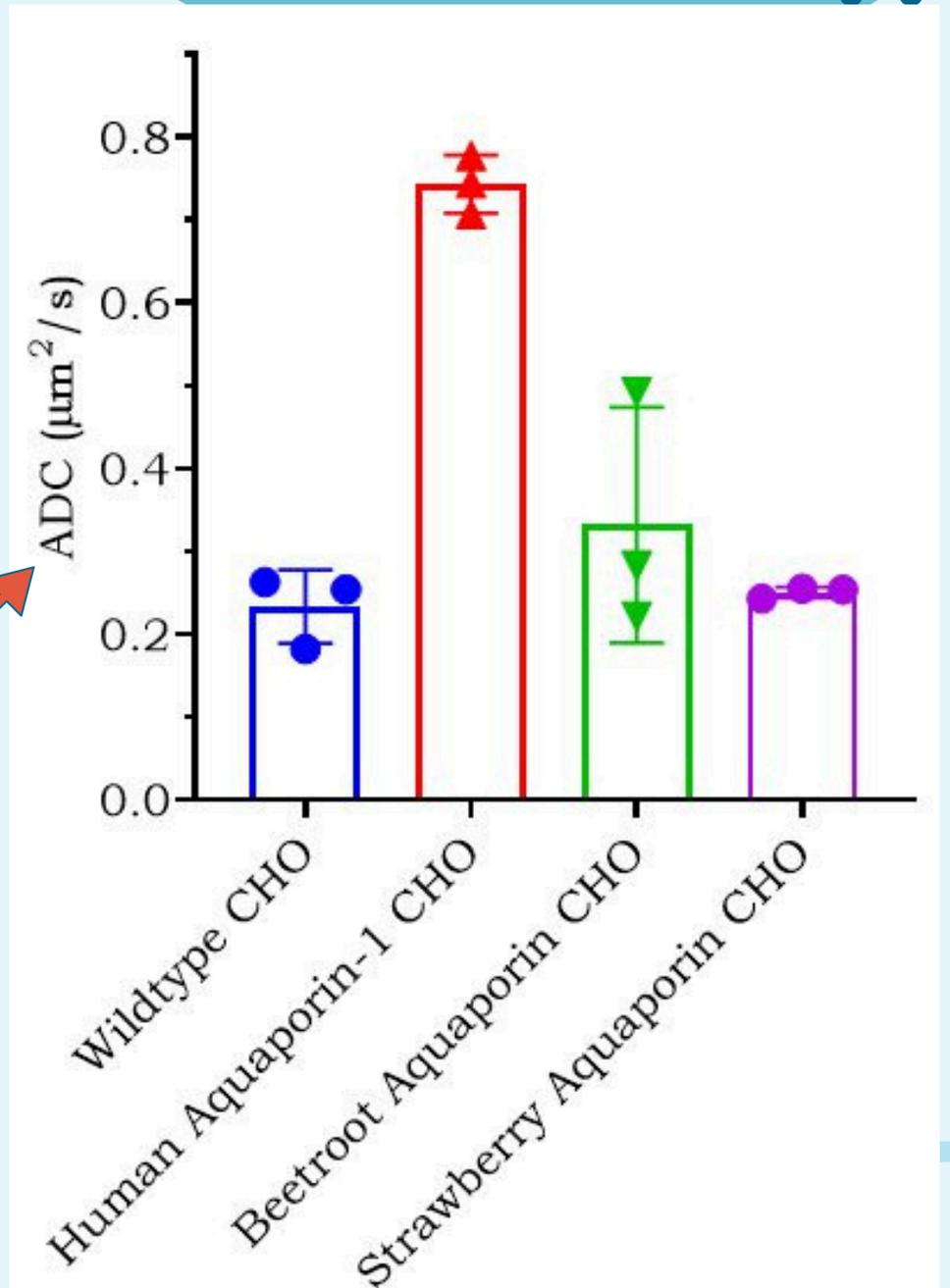


**The Phantom  
Device**



# Our MRI data

Apparent Diffusion Coefficient  
(amount of water diffusion)



**We're still looking for the most efficient plumbing system out there!**

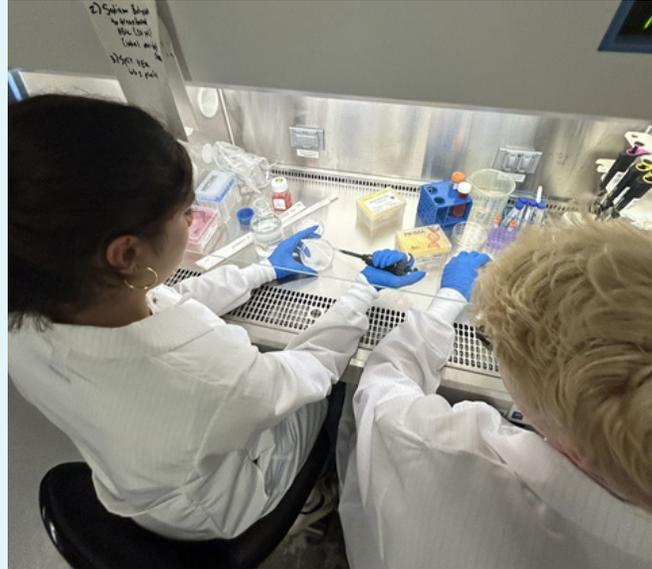
**Future Work:**





# The Future of Our Field?

# What We Learned



**Time  
Management**

**Exposure to  
Graduate Level  
Research**

**Communicating  
Scientific  
Research**

# Acknowledgements



**Dr. Arnab Mukherjee**

**Mentor**

**Dr. Kaamini**

**Grad students**

**Logan, Binzhi, Thomas, Austin**

**Undergrad Student**

**Patrick**

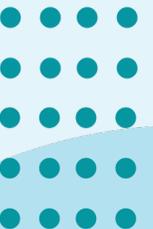
**AR Program staff**

**Wendy Ibsen**

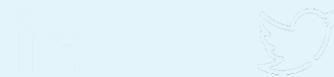
**Ali Muller**

**Marilyn Garza**

**Kara Chatterton**



# Thank you!



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